STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
Stream Protection and Management Branch

FIELD INVESTIGATION REPORT

FI2008111702 (East Maui, Kano Koolau Ditch, restore)

Date of Field Investigation: November 17, 2008 **Time** (24-hour)**:** 1010 - 1500	
CWRM Staff:	Ed Sakoda, Dean Uyeno, and Chui Ling Cheng
Individuals Present:	EMI - Garret Hew (Water Resources Manager), Mark Vaught (Operations Manager), Henry Robello (Field Superintendent), and Nelson Akiu (Keanae Supervisor)
Hydrologic Unit:	Piinaau (6053)
Stream Name:	Kano Stream (tributary of Palauhulu Stream)

Findings:

The purpose of the field visit was to document flow release at the Koolau Ditch bypass sluice gate on Kano Stream, a tributary of Palauhulu Stream. At 1010 hours, CWRM staff met with Garret Hew and EMI staff at the junction of Hana Highway and Piinaau Road. Staff drove up Piinaau Road, and then turned left onto Kano Road. The switch-back trail to the Koolau Ditch bypass sluice gate on Kano Stream begins near the end of Kano Road, along the side of the mountain. EMI staff had previously cleared the trail for the safety of CWRM staff. At the end of the trail is Kano Falls, a cascading waterfall directly upstream of Koolau Ditch. The sluice gate is located inside a tunnel, on the right bank at the foot of the waterfall (inside the pool). At approximately 1200 hours, Nelson Akiu and Garret Hew proceeded to lift up the bypass sluice gate. Once the gate was opened, water from the ditch flowed through the gate and out the side of the mountain, creating a waterfall. Very little water was flowing into the ditch. CWRM staff videotaped the flow release event.

CWRM staff measured the dimensions of the sluice gate to be 1.1 x 6.8 feet (W x H). The sluice gate was opened to a height of 0.45 feet.

According to the trip schedule, CWRM staff had planned to take flow measurements at Kano Stream near Koolau Ditch to estimate the amount of water that would be lost to the losing sections downstream from the ditch, before reaching IIFS Site B on Palauhulu Stream. However, the stream section near the ditch was mostly large boulders, without any well-defined sections suitable for flow measurements. Therefore, staff decided to take flow measurements near the Koolau Ditch bypass sluice gate to approximate the discharge that would flow into Kano Stream. Depth and velocity measurements were taken 3 feet downstream from the sluice gate at only three points along the cross section due to the turbulent flow conditions.

Number	Width of section (ft)	Depth of water (ft)	Velocity (ft/sec)	Discharge (CFS)
1	3.00	0.55	3.68	6.072
2	3.00	0.55	3.96	6.534
3	3.00	0.40	3.33	3.996

CFS = cubic feet per second

As computed back in the Honolulu Office, the average discharge was 5.534 CFS (3.577 million gallons per day). This flow measurement represents a very rough estimate of the discharge in Kano Stream. It does not have the same accuracy as the previous flow estimates where depth and velocity measurements were taken at equal intervals along the cross section.

On the drive back, CWRM staff stopped along Kano Road right before merging with Piinaau Road to access Palauhulu Stream downstream from Kano Falls and Koolau Ditch. Staff hiked from the road to the left bank of the stream, and continued to hike downstream. Staff located a suitable site for flow measurements and made necessary preparations. The site was not flagged because this location was not intended to be an IIFS site. Flow measurement was completed in 30 minutes. Staff recorded wind velocity, air temperature, water temperature and weather conditions. Weather was partly cloudy. As computed back in the Honolulu Office, the flow was 2.802 CFS (1.811 million gallons per day), with no gage height readings. Heavy rain began to fall as staff were hiking back to Kano Road.

CWRM staff were scheduled to return to IIFS Site B on Palauhulu Stream on the third day of the field visit (Wednesday, Nov. 19) and take flow measurements. However, heavy rain fell on East Maui the following day (Tuesday). Most of the streams in East Maui had flow velocities too high for taking measurements. Instead, staff documented the high flow events by taking photographs, descriptions, and GPS waypoints.

Staff concluded the field investigation at 1500 hours.

Image Listing: (Attach PDF of image contact sheet)

File Name:	Brief Description:
20081117001	The 2001 landslide that covered part of Piinaau Stream.
20081117002	View of Keanae Valley from the hiking trail near Kano Road.
20081117004	Kano Falls upstream of Koolau Ditch on Kano Stream.
20081117005	The pond of Kano Falls upstream from Koolau Ditch.
20081117008	Cascading waterfall of Kano Falls upstream of Koolau Ditch on Kano Stream.
20081117011	The radio gate on the right bank of Kano Stream near the waterfall.
20081117013	Radio gate on the right bank of Kano Stream near the waterfall. This gate controls the water level in Koolau Ditch.
20081117015	Remnants of a concrete-reinforced masonry (CRM) wall on the left bank of Kano Stream near the waterfall.
20081117019	An open tunnel that is part of the Koolau Ditch on the left bank of Kano Stream near the waterfall.
20081117022	Cascading waterfall of Kano Falls upstream of Koolau Ditch on Kano Stream. Photo taken from the right bank.
20081117024	The top part of the cascading waterfall of Kano Falls upstream of Koolau Ditch on Kano Stream. Photo taken from the right bank.
20081117026	Tunnel that leads to the Koolau Ditch bypass sluice gate on Kano Stream.
20081117027	Koolau Ditch bypass sluice gate on Kano Stream.
20081117028	Tunnel downstream the Koolau Ditch bypass sluice gate on Kano Stream, where water from Kano Stream exits on the side of the mountain.
20081117032	End of the tunnel downstream the Koolau Ditch bypass sluice gate on Kano Stream, where water from Kano Stream exits on the side of the mountain.
20081117033	Water from Kano Stream flowing into Koolau Ditch.
20081117034	EMI staff opening the Koolau Ditch bypass sluice gate on Kano Stream.
20081117035	Tunnel downstream the Koolau Ditch bypass sluice gate on Kano Stream, where water from Kano Stream exits on the side of the mountain. The sluice gate has already opened.
20081117037	Koolau Ditch bypass sluice gate opened on Kano Stream.
20081117046	CWRM staff taking flow measurements 3 feet downstream from the Koolau Ditch bypass sluice gate on Kano Stream.
20081117047	Koolau Ditch bypass sluice gate opened on Kano Stream.
20081117048	Water from Kano Stream no longer flowing into Koolau Ditch after the Koolau Ditch bypass sluice gate was opened.
20081117053	Water from Kano Stream flowed through the bypass sluice gate and out the side of the mountain.
20081117055	Upstream from the measurement site on Palauhulu Stream. This location is downstream from Koolau Ditch.
20081117057	Downstream from the measurement site on Palauhulu Stream. This location is downstream from Koolau Ditch.
20081117058	CWRM staff preparing the site on Palauhulu Stream for flow measurement.
20081117059	CWRM staff preparing the site on Palauhulu Stream for flow measurement.
20081117061	CWRM staff taking flow measurement at Palauhulu Stream, downstream from the Koolau Ditch.
20081117063	CWRM staff taking flow measurement at Palauhulu Stream, downstream from the Koolau Ditch.

GPS Listing:

Shapefiles: (List file names of all shapefiles created and a brief description of each)

File Name:	Brief Description:
FI20081117wp.shp	Waypoints recorded during the field visit from Nov. 17-19, 2008.

Waypoints: (List all waypoints in decimal degrees and provide a brief description of each)

WP No.	Latitude	Longitude	Brief Description:
001	20.81567106	-156.16222948	Pool below Kano Falls, near Koolau Ditch intake at Kano Stream
002	20.81569428	-156.16190384	Access tunnel to Koolau Ditch bypass sluice gate
003	20.81781037	-156.16314051	Start of trail to Koolau Ditch intake at Kano Stream
005	20.81855167	-156.16347067	Flow measurement site on Palauhulu Stream, downstream from Koolau Ditch
006	20.82588055	-156.16540278	Bridge across Hauolo Wahine Stream
008	20.8563569	-156.14677216	EMI access gate on Piinaau Road

Attachments:

Brief Description:

1. Image Contact Sheet
2. Discharge Measurement and Gage Inspection Notes

Recommendations:

IMAGE CONTACT SHEET

20081117001.JPG

20081117002.JPG

20081117004.JPG

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IMAGE CONTACT SHEET


20081117027.JPG


20081117028.JPG


20081117032.JPG


20081117033.JPG

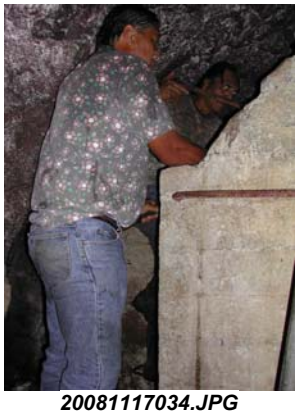
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IMAGE CONTACT SHEET

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Form 9-275F
(Apr. 2001)

U.S. DEPARTMENT OF THE INTERIOR
U.S. Geological Survey
WATER RESOURCES DIVISION
DISCHARGE MEASUREMENT AND GAGE INSPECTION NOTES

Meas. No. _____

Comp. by CHui

Checked by DBM

Sta. No. PALAUHULU DOWNSTR OF KOOLAU DITCH

Sta. Name _____

Date 11/17 , 20 08 Party Dean, Chui, Ed

Width 5.75 Area 3.706 Vel. 0.76 G.H. _____ Disch. 2.802

Method Wading No. secs. 40 G.H. change _____ in _____ hrs.

Method coef. _____ Horiz. angle coef. _____ Susp. _____ Tags checked _____

Meter Type _____ Meter No. _____ Meter _____ ft. above bottom of wt.

Rating used _____ Spin test before meas. _____ ; after _____

Meas. plots _____ % diff. from rating no. _____ Indicated shift _____

GAGE READINGS						
Time					Inside	Outside
	Start	LEW @ 1453				
	Finish	REW @ 1523				
Weighted MGH						
GH correction						
Correct MGH						

Samples collected: water quality, sediment, biological, other _____

Measurements documented on separate sheets: water quality, aux./base gage, other _____

Rain gage serviced/calibrated ____

Weather: overcast

Air Temp. 26 °C at 1503

Water Temp. 20 °C at 1516

Check bar/chain found _____

Changed to _____ at _____

Correct _____

Wading, cable, ice, boat, upstr., downstr., side bridge, 1/4 ft., (mi) upstr., downstr. of waterfall gage.

Measurement rated excellent (2%), good (5%), fair (8%), poor (> 8%); based on following conditions: Flow: parts laminar, non-uniform velocity

Cross section: bedrock, pebbles, cobbles

Gage operating: _____ Record Removed _____

Battery voltage: _____ Intake/Orifice cleaned/purged: _____

Bubble-gage pressure, psi: Tank _____ , Line _____ ; Bubble-rate _____ /min.

Extreme-GH indicators: max _____ , min _____ .

CSG checked: _____ HWM height on stick _____ Ref. elev. _____ HWM elev. _____

HWM inside/outside: _____

Control: _____

Remarks: _____

GH of zero flow = GH _____ - depth at control _____ = _____ ft., rated _____

Sheet No. _____ of _____ sheets

.0 .10 .20 .30 .40 .50 .60 .70 .75

River at -

	ANGLE COEFFICIENT	DIST. FROM INITIAL POINT	WIDTH	DEPTH	OBSERVATION DEPTH	REVOLUTIONS	TIME IN SECONDS	VELOCITY AT POINT	VELOCITY MEAN IN VERTICAL	ADJUSTED FOR HOR. ANGLE OR	AREA	DISCHARGE	.80
		LEW	@	1453									
		4.7	.20	0									.85
		~~4.9~~		~~0.1~~			~~EST=~~				~~.048~~		
		5.1	.30	0.16			EST=	.5(.26)	0.13		.048	.006	
		5.3	.20	0.25			40		0.26		.050	.013	.90
		5.5	.20	0.38			40		0.31		.076	.024	.92
		5.7	.20	0.54			40		0.28		.108	.030	
		5.9	.20	0.43			40		0.44		.086	.038	.94
		6.1	.20	0.50			40		0.56		.100	.056	.96
		6.3	.20	0.60			40		0.67		.120	.080	.97
		6.5	.20	0.56			40		0.72		.112	.081	.98
		6.7	.20	0.46			40		0.76		.092	.070	.99 .398
		6.9	.20	0.45			40		0.73	.892	.090	.066	
		7.1	.20	0.50			40		0.63		0.100	.063	
⊙		7.3	.20	0.70			40		0.49		0.140	.069	1.00
		~~7.5~~		~~0.80~~			~~40~~		—				
		7.5	.20	0.90			40		0.46		0.180	.083	
		7.7	.20	0.92			40		0.72		0.184	.132	.99
		7.9	.20	0.90			40		0.84		0.180	.151	
		8.1	.20	0.90			40		0.98		0.180	.176	.98
		8.3	.20	0.92			40		1.02		0.184	.188	.97
		8.5	.20	0.90			40		0.98		0.180	.176	.96 1.326
		8.7	.20	0.92			40		0.97		0.184	.178	.94
		8.9	.20	1.03			40		0.95	2.6	0.206	.196	.92
		9.1	.20	1.18			40		0.89		0.236	.210	.90 2.086
		~~9.3~~		~~1.05~~			~~40~~		—				
		9.3	.20	1.15			40		0.90		0.230	.207	
		9.5	.20	1.01			40		0.86		0.202	.174	.85
		9.7	.20	1.01			40		0.85	3.43	0.202	.172	2.639
		9.9	.20	0.60			40		0.76		0.120	.091	
		10.1	.20	0.45			40		0.70		0.090	.063	.80
		10.3	.175	0.15			EST=	.5(0.7)	0.35		0.026	.009	

.0 .10 .20 .30 .40 .50 .60 .70 .75

River at -

ANGLE COEFFICIENT	DIST. FROM INITIAL POINT	WIDTH	DEPTH	OBSERVATION DEPTH	REVOLUTIONS	TIME IN SECONDS	VELOCITY AT POINT	VELOCITY MEAN IN VERTICAL	ADJUSTED FOR HOR. ANGLE OR	AREA	DISCHARGE	
	10.45	0.075	0									.80
												.85
	5.75	5.75					AVG=	0.76		3.706	2.802	
	REW @ 1523											
												.90
												.92
												.94
												.96
												.97
												.98
												.99
⊙												1.00
												.99
												.98
												.97
												.96
												.94
												.92
												.90
												.85
												.80